REMARKS

Claim 41 has been amended. Claims 1-11, 13-61, and 134-136 remain pending. Applicant reserves the right to pursue the original claims and other claims in this and other applications. Please reconsider the above-referenced application in light of the amendment and following remarks.

Claims 1-40 and 134-136 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,898,196 ("Hook"). The rejection is respectfully traversed.

At the outset, Applicant respectfully submits that in an anticipation rejection, "[n]o question of obviousness is present. In other words, for anticipation under 35 U.S.C. 102, the reference must teach *every aspect* of the claimed invention either explicitly or impliedly. Any feature not directly taught must be inherently present." M.P.E.P. § 706.02. Applicant respectfully submits that the Office Action has not set forth a proper case of anticipation under 35 U.S.C. § 102(b). Hook does *not* disclose or teach, explicitly or inherently, *every aspect* of Applicant's claimed invention that is recited in claims 1-40 and 134-136.

Hook does not teach an image device comprising, *inter alia*, "at least one isolation trench provided in a substrate having a first conductivity type, said substrate having a first dopant concentration; a doped region having said first conductivity type surrounding at least a portion of said trench in said substrate, said doped region having a second dopant concentration; and a photosensitive region formed approximately less than 0.30μ away from the at least one isolation trench and the doped region," as recited in claim 1. Specifically, Hook does not disclose a doped region that surrounds at least a portion of a trench in a substrate, much less a photosensitive region formed approximately less than 0.30μ away from the trench.

Hook does not disclose an image structure comprising, *inter alia*, "a trench isolation region surrounded at least in part by a first doped region with a first conductivity type having a first impurity implant dose, wherein said first doped region is surrounded by a second doped region of said first conductivity type having a second impurity dose implant concentration; and a charge collection region with a second conductivity type formed to be approximately less than 0.30μ away from said trench isolation region," as recited in claim 22. Specifically, Hook does not disclose a first doped region that surrounds at least a portion of a trench isolation region, much less a charge collection region formed approximately less than 0.30μ away from the trench isolation region.

Hook does not teach a processing system with a photosensor comprising, *inter alia*, "at least one isolation trench provided in a substrate having a first conductivity type, said substrate having a first dopant concentration; a doped region having said first conductivity type surrounding at least a portion of said trench in said substrate, said doped region having a second dopant concentration; and a photosensitive region formed approximately less than 0.30μ away from the at least one isolation trench and the doped region," as recited in claim 134. Specifically, Hook does not disclose a processing system, a doped region that surrounds at least a portion of a trench in a substrate, much less a photosensitive region formed approximately less than 0.30μ away from the trench.

Hook does not disclose a processing system with an imager structure comprising, *inter alia*, "a trench isolation region surrounded at least in part by a first doped region with a first conductivity type having a first impurity implant dose, wherein said first doped region is surrounded by a second doped region of said first conductivity type having a second impurity dose implant concentration; and a charge collection region with a second conductivity type formed to be approximately less than

0.30μ away from said trench isolation region," as recited in claim 135. Specifically, Hook does not disclose a processing system, a first doped region that surrounds at least a portion of a trench isolation region, much less a charge collection region formed approximately less than 0.30μ away from the trench isolation region.

Similarly, Hook does not teach a photosensitive pixel comprising, *inter alia*, "a p-n-p photodiode comprising an n-type charge collection region formed in a p-type substrate and a p-type surface region located above said charge collection region, said p-type substrate having a first implant dose and said p-type surface region having a second implant dose; an isolation trench region laterally spaced apart by less than approximately 0.30μ from said charge collection region; and a doped p-type implant region surrounding at least a portion of said isolation trench region, wherein said doped p-type implant region has a third implant dose," as recited in claim 136. Specifically, Hook does not disclose a doped p-type implant region that surrounds at least a portion of a isolation trench region, much less an isolation trench region laterally spaced apart by less than approximately 0.30μ from a charge collection region.

As indicated above, Hook does *not* disclose a trench isolation region in any of the FIGS. Hook does *not* disclose that a *doped region* surrounds at least in part, the trench isolation region. Similarly, Hook does *not* disclose that the trench isolation region is formed by less than approximately 0.30μ from a charge collection or photosensitive region. In the prior art, a doped region was not formed around the trench isolation region. As a result, the photosensitive or charge collection region was formed at least 0.30μ away from a trench isolation region. Applicant's claimed structure allows the photosensitive or charge collection region to be formed closer to the trench isolation region. This in turn, allows the photosensitive or charge collection region to be formed larger which increases the photosensor's ability to collect photogenerated charge. This is not possible in Hook.

For example, the Office Action asserts that Hook discloses an image device with a photosensor comprising at least one isolation trench in a substrate 24, with a doped region surrounding at least a portion of the trench (Office Action, pg. 2). The Office Action relies upon Col. 3, ll. 36 in Hook as support. Applicant respectfully disagrees. Hook's Col. 3, ll. 33-36, states that "[b]y adjusting processing conditions in a well known manner, silicon is prevent from forming over the oxide left in the logic region." Hook does not disclose at least one trench isolation region, much less that a doped region surrounds a portion of the trench.

The Office Action further asserts that Hook discloses, in Col. 3 and FIG. 2a, a photosensitive region formed approximately less than 0.30μ from a trench isolation region. Again, Applicant respectfully disagrees. There is *no disclosure* in Hook's Col. 3, much less FIG. 2a, that a photosensitive region is formed approximately less than 0.30μ away from an isolation trench region and a doped region.

Hook relates to "a dual epi active pixel sensor cell having a p-region of dual thicknesses." (Abstract). To this end, Hook discloses in FIG. 2a, a "thick p-mepi area 36 of approximately 5 microns or greater is used in the diode areas, while thin p-areas 36 of approximately 2 microns is used in the logic areas." (Col. 3, ll. 2-5). The thick regions are formed in the pixel region 20' and the thin regions are formed in the logic regions 20'' (FIG. 2a). Hook does not disclose a trench isolation region with a surrounding doped region, much less a charge collection region formed to be approximately less than 0.30μ away from a trench isolation region.

As discussed previously, Applicant's claimed invention relates to forming a doped region 171 that *surrounds* at least a portion of trench isolation region 150b (FIG. 5B). The doped region allows the photodiode's 188 charge collection region 121 to be formed closer to the isolation region 150b. Since the photodiode 188 can be formed

closer to the trench isolation region 150b, the n-type region 126 of photodiode 188 can be formed to have a larger charge holding capacity, *i.e.*, a larger charge collection region 121.

In addition, the p-type pinned surface layer 124, the p-well 194, and p-type region 171 form a linking region that electrically connects the pinned surface region 124 to p-well region 194 through p-type region 171. In the prior art (FIGS. 3A-3B), a pinned photodiode 11 would have to be formed at least 0.30μ *away* from the trench isolation region 15 (FIG. 3B). Applicant's claimed invention allows the charge collection region 121 or photodiode 188 to be formed *less than* 0.30μ away from a trench isolation region 150b. Hook does not teach anything to this effect, explicitly or inherently. If anything, Hook would merely teach a *conventional* photodiode or charge collection region that would be formed at least 0.30μ *away* from a trench isolation region.

Claims 2-21 depend from claim 1 and should be similarly allowable along with claim 1 for at least the reasons provided above, and on their own merits. Claims 23-40 depend from claim 22 and should be similarly allowable along with claim 2 for at least the reasons provided above, and on their own merits.

For instance, Hook does not disclose any implant dose concentrations for a photodiode region or doped region. Hook fails to disclose a doped region that has " an implant dose of from approximately $3.0x10^{11}$ atoms/cm^2 to approximately $3.0x10^{13}$ atoms/cm^2," as recited in claims 7 and 24, or "an implant dose of from approximately $5.0x10^{11}$ atoms/cm^2 to approximately $6.0x10^{12}$ atoms/cm^2," as recited in claims 8 and 25. Hook fails to disclose a photodiode or charge collection region that is formed "approximately 0.15μ to approximately 0.00μ away from [a] trench and doped region," as recited in claims 13 and 34.

Hook fails to disclose any implant concentrations. For example, Hook does not teach that the "substrate has a p-type implant concentration of from about $1.0x10^{14}$ atoms/cm^3 to about $1.0x10^{16}$ atoms/cm^3," as recited in claim 14, or "a p-type implant concentration of from about $5.0x10^{14}$ atoms/cm^3 to about $3.0x10^{15}$ atoms/cm^3," as recited in claim 15.

Similarly, Hook fails to disclose a "p-well region having an implant dose of from about $5.0x10^{11}$ atoms/cm^2 to about $5.0x10^{13}$ atoms/cm^2," as recited in claim 16, or a "p-well region [which] has an implant dose of from about $1.0x10^{12}$ atoms/cm^2 to approximately $1.0x10^{13}$ atoms/cm^2," as recited in claim 17. Hook simply does *not* disclose or teach, explicitly or inherently, *every aspect* of Applicant's claimed invention that is recited in claims 1-40 and 134-136. M.P.E.P. § 706.02. For at least these reasons, the 35 U.S.C. § 102(b) rejection should be withdrawn with regards to claims 1-40 and 134-136.

Claims 41-61 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,483,163 ("Isogai"). The rejection is respectfully traversed.

Isogai does *not* disclose or teach, explicitly or inherently, *every aspect* of Applicant's claimed invention that is recited in claims 41-61. M.P.E.P. § 706.02. Isogai does not disclose a photodiode structure comprising, *inter alia*, "a first doped region having a first conductivity type formed in a substrate, said first doped region in contact with a second doped region having said first conductivity type, said second doped region formed laterally adjacent to a trench isolation region; a third doped region with a second conductivity type that accumulates photo-generated charge formed beneath said first doped region and adjacent to said second doped region; and a fourth doped region having said first conductivity type formed at least in part beneath said second doped region," as recited in claim 41.

The Office Action asserts that Isogai discloses Applicant's claimed photodiode structure in FIGS. 3-4 and Col. 20, ll. 40-48. Applicant respectfully disagrees. Isogai discloses a conventionally formed photodiode 1. Isogai teaches that "photodiode 1 includes a P-type charge-accumulation region 12, formed in the N-type semiconductor layer 101 over the high-density N-type semiconductor substrate 100." (Col. 20, ll. 40-43). The photodiode 1 further comprises n-type region 13 that covers p-type charge accumulation region 12 (Col. 20, ll. 43-48).

Isogai does not teach that a second doped region is formed laterally adjacent to a trench isolation region, much less a photodiode structure with first, second, third, and fourth doped regions. At best, Isogai discloses a photodiode with a first doped n-region 13, a second doped region 12, and a third doped region 101. As indicated above, Applicant's claimed invention allows the third doped region to be formed less than 0.30μ away from the second doped region, as recited in dependent claim 56.

Claims 42-61 depend from claim 41 and should be similarly allowable along with claim 41 for at least the reasons provided above, and on their own merits. For instance, Isogai does not disclose any implant dose concentrations as recited in claims 43-51, that the second doped region surrounds at least a portion of the trench isolation region as recited in claim 59, a fifth doped region as recited in claim 51, a fifth doped region's implant dose concentrations as recited in claims 52 and 53, or a photodiode structure that is a pnp photodiode as recited in claim 60. Isogai's photodiode 1 is a npn photodiode. Isogai simply does *not* disclose or teach, explicitly or inherently, *every aspect* of Applicant's claimed invention that is recited in claims 41-61. M.P.E.P. § 706.02.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to review and pass this application to issue.

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Respectfully ~~submitted~~,

By _____

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